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Case Report

Endovascular Stent Graft Repair of a Ruptured Superior Mesenteric Artery Aneurysm

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A ruptured aneurysm of the superior mesenteric artery (SMA) is very rare. In recent years, there have been some reports of successful endovascular therapy of SMA aneurysms. However, endovascular stent graft repair of a ruptured SMA aneurysm has not been reported previously. We report on a 50-year-old man with a ruptured aneurysm of the proximal SMA. Using an endovascular approach, the aneurysm was initially excluded with 2 stent grafts. Two weeks following the first procedure, computed tomography angiography revealed a proximal endoleak, which was treated with another stent graft. The endovascular stent graft repair finally resulted in total exclusion of the ruptured aneurysm. Patency of the SMA was maintained and no ischemic complications occurred.

Key words: Endovascular repair – Ruptured aneurysm – Superior mesenteric artery – Stent graft

Visceral artery aneurysms (VAAs), which comprise celiac, superior and inferior mesenteric, and renal arteries, represent only 0.1% to 0.2% of vascular aneurysms.[1,2] Hepatic and splenic artery aneurysms are the most common VAAs, occurring in 80% of cases.[3] In contrast, only 5.5% of VAAs are located in the superior mesenteric artery (SMA), primarily in the first 5 cm of the artery.[3] Ruptured aneurysms of the SMA are potentially life-threatening, with a mortality rate of up to 30%.[3] In such cases, emergency laparotomy with aneurysmectomy and arterial reconstruction or segmental resection of the involved bowel is frequently used.[4,5]

A systematic electronic health database search was performed using PubMed, OvidSP, and the Cochrane Database on all accessible published articles from inception to February 2015. An additional search for abstracts presented in international congresses for vascular surgery was also performed. There have been some reports of successful endovascular therapy for SMA aneurysms and dissections using endovascular stent

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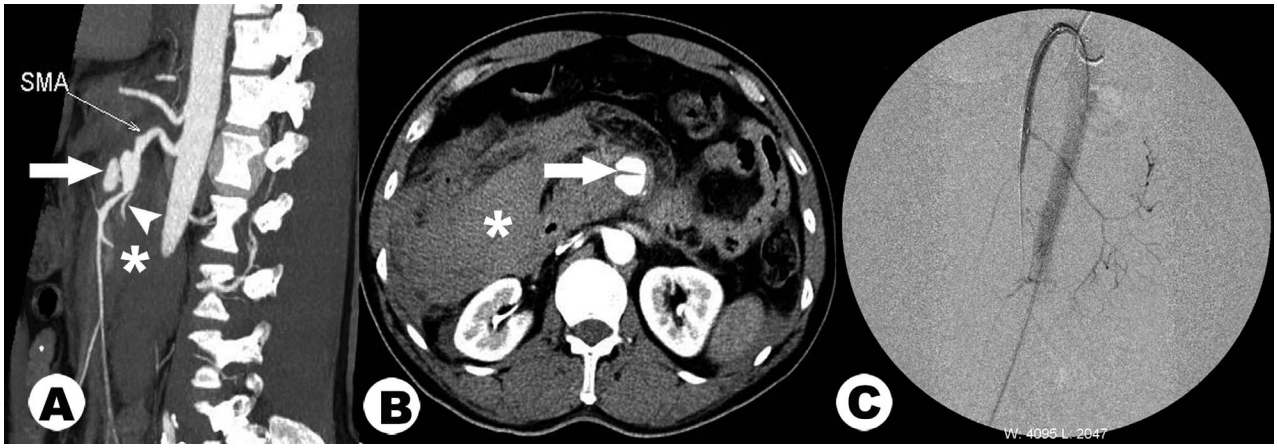

Fig. 1 (A) Sagittal imaging and (B) axial imaging. Computed tomography angiography showing a ruptured aneurysm of the superior mesenteric artery (arrow) with a huge retroperitoneal hematoma (asterisk) and a small branch originating from the region of the aneurysm (arrowhead). (C) Angiogram after stent graft implantation.

graft implantation.[6,7] However, endovascular stent graft repair of a ruptured SMA aneurysm has not been reported in the literature as far as we know. Herein, we report a case of a ruptured SMA aneurysm that was successfully excluded with stent grafts.

Case Report

A 50-year-old man was admitted to our emergency department with complaints of having abdominal pain of unknown causes for 16 hours. He had a medical history of poorly controlled hypertension. Results of an emergency computed tomographic angiography (CTA) showed a ruptured aneurysm of the SMA (Fig. 1A and 1B). The aneurysm had a transverse diameter of 23 mm and a length of 40 mm, along with a huge retroperitoneal hematoma. The ruptured site was located in the anterior wall of the aneurysm. The beginning of the aneurysm was within the proximal segment of the artery, about 50 mm distal to the ostium of the SMA. There was only a small branch originating from the region of the aneurysm.

The patient experienced sudden loss of consciousness after the CTA scan, with acute hypotension (his blood pressure dropped from 106/79 to 52/34 mmHg) and tachycardia (his heart rate was elevated from 90 to 140 bpm). Tracheal intubation and antishock treatment were provided immediately. Given the emergent status and the favorable anatomic conditions, an endovascular approach was performed.

After general anesthesia, a 6F introducer sheath with a length of 11 cm (Cordis, Johnson & Johnson, New Brunswick, New Jersey) was placed percutaneously through the right groin. Using a 5F C2 catheter with a length of 100 cm (Cordis), selective angiography was performed and the existence of a ruptured SMA aneurysm was confirmed (Fig. 1C). A 0.035-inch/150-cm radifocus M guidewire (Terumo, Tokyo, Japan) with an angled tip was used to cross the aneurysm. The catheter was advanced to the distal SMA, and the 0.035-inch/260-cm EMERALD guidewire (Cordis) was then reinserted. A 6×60 mm stent graft (Fluency, Bard, Tempe, Arizona) was advanced and implanted to exclude the aneurysm. The proximal end of the stent was located at a point approximately 15 mm distal to the SMA origin, with sufficient proximal and distal overlap. After stent graft implantation, a 6F introducer sheath with a length of 45 cm was slightly advanced. Angiography performed through this sheath showed a distal endoleak. Another 6×60 mm stent graft (Fluency) was implanted at a position about 1 cm above the distal end of the first one. Results of a repeat angiography showed no signs of residual endoleak or distal embolism (Fig. 1C). The procedure was successfully completed without any complications.

Two weeks following the procedure, results of a repeat CTA showed an endoleak around the proximal end of the stent graft (Fig. 2A). Therefore, the patient underwent a second endovascular treatment. After local anesthesia, abdominal aortography was performed and the existence of a proximal endoleak was confirmed. After inserting a guidewire, an 8×60 mm stent graft (Fluency) was

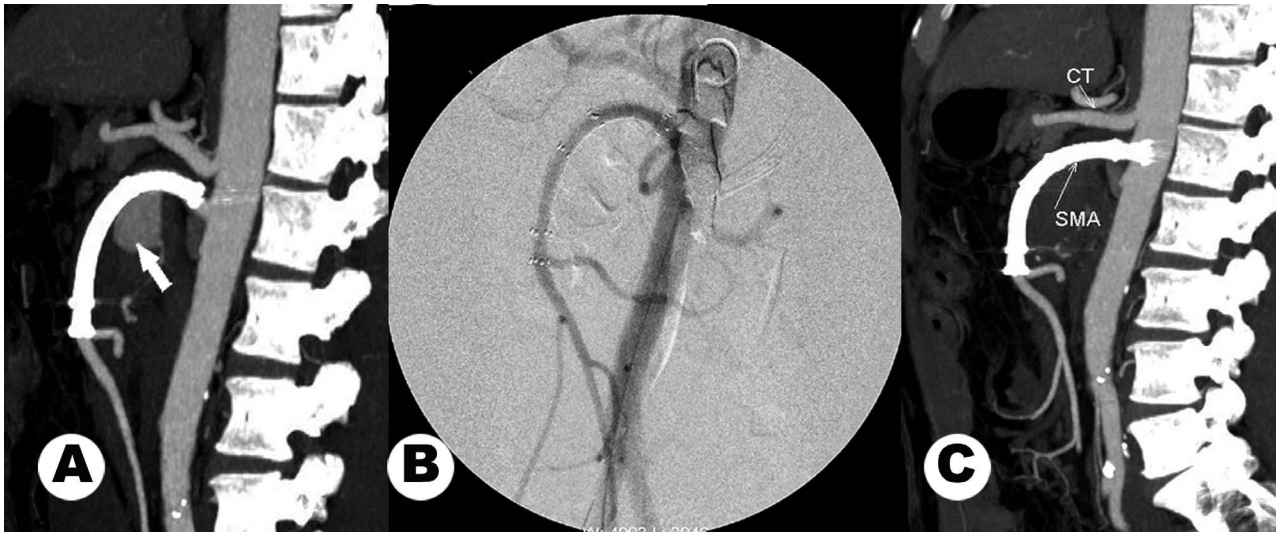

Fig. 2 (A) Computed tomography angiography scan showing a sign of endoleak (arrow) 2 weeks after the intimal stent graft implantation. (B) Angiogram after repeat stent graft implantation showing successful sealing of the endoleak with continued patency of the SMA. (C) Computed tomography angiography 1 week after the second procedure showing a patent stent graft without remaining flow in the aneurysm sac.

implanted, with its proximal end extending into the aorta. After stent graft implantation, an 8 × 60 mm balloon (Admiral Xtreme Medtronic, Roncadelle, Brescia, Italy) was inserted and dilated to attach the stent graft to the wall of the SMA. Results of the final angiography confirmed successful sealing of the endoleak with the continued patency of the SMA (Fig. 2B). CTA was repeated 1 week after the procedure; it showed a patent stent graft without remaining flow in the aneurysm sac (Fig. 2C). The patient received antiplatelet therapy with oral aspirin 100 mg/d. His condition was normal and symptom-free 3 months later.

Discussion

The incidence of VAAs as a group is extremely rare, and no single institution encounters the disease with sufficient frequency to estimate accurately its overall incidence in the population. Because of the widespread use of diagnostic imaging, VAAs are more frequently diagnosed than in the past decades.[1,2,8,9] Although declining, mycotic aneurysm is a common cause of SMA aneurysms, accounting for 33% to 66% of cases.[10] Other common causes include inflammation, vasculitis, trauma, arterial dissection, and dysplastic and degenerative aneurysm. Apart from hypertension, the patient had no medical history of inflammation, trauma, or vasculitis. Therefore, the cause of his SMA aneurysm might be degeneration. Most SMA aneurysms are symptomatic, mainly presenting with acute colicky abdominal pain, nausea, and vomiting. These symptoms may be attributed to the aneurysmal embolization to the distal vascular bed and the narrowing lumen of the SMA. The ruptured SMA aneurysms are usually characterized by severe abdominal pain and shock, and are associated with a high mortality.[3]

When an SMA aneurysm ruptures, emergency laparotomy with aneurysmectomy and arterial reconstruction is frequently used.[4,5] Reconstruction is needed to prevent intestinal ischemia and is usually accomplished by autologous vein grafts, which are favored over prosthetic conduits.[5] In view of the critical condition involving unconsciousness and hypotension, the patient definitely would take great risks if he undergoes open surgery.

Some ruptured aneurysms of the SMA have been treated successfully with endovascular coil embolization, a promising option with a primary success rate slightly higher than 89% and a secondary success rate of 100%.[11,12] However, these aneurysms were always located in the branch of the SMA. If the main trunk of the SMA is involved, the aneurysm cannot be occluded by coil embolization to avoid intestinal ischemia or necrosis.[1,13] In this situation, endovascular stent graft implantation provides a solution that ensures uninterrupted patency of the SMA. Complete exclusion of the aneurysm is also feasible.[6,14] In the patient described in the current study, results of the

preoperative CTA showed that the aneurysm was located at about 50 mm distal to the origin of the SMA. There was only a small branch originating from the region of the aneurysm. The favorable anatomy for endovascular stent graft repair ensured sufficient stenting zone and avoided intestinal ischemia caused by major branch covering. Therefore, endovascular stent graft repair was selected for such case, and a good short-term result was finally achieved.

Results of a CTA showed an endoleak originating from the proximal end of the stent graft at 2 weeks after the first procedure. The reason may be compression of the SMA caused by the retroperitoneal hematoma and shrinkage caused by hemorrhagic shock during the first procedure. When the diameter of the SMA was restored after the procedure, the proximal 6-mm diameter stent graft became too small, and then the endoleak occurred. After another 8-mm diameter stent graft was inserted at the proximal segment of the SMA, the endoleak immediately disappeared. Therefore, it was suggested that a slightly larger stent graft should be selected for endovascular repair of the ruptured SMA aneurysm compared with the repair of the nonruptured one.

In conclusion, endovascular treatment of ruptured SMA aneurysms with stent grafts is a feasible therapeutic option. It can be performed with a low rate of complication, thus avoiding the risks of open surgery in patients under critical condition.

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